

FORM PTO-1390
(REV. 9-2001)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

16795-2

U.S. APPLICATION NO. (if known, see 37 CFR 1.5

10/070582

INTERNATIONAL APPLICATION NO.
PCT/CH00/00483

INTERNATIONAL FILING DATE
8 September 2000

PRIORITY DATE CLAIMED
9 September 1999

TITLE OF INVENTION INKJET PRINTING DEVICE FOR INKS CONTAINING A HIGH LOADING OF PIGMENT
AND INKJET PRINTING PROCESS UTILIZING SAID DEVICE

APPLICANT(S) FOR DO/EO/US Dennis CROCKETT; Alan L. HUDD; Christopher M. EVANS

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☐ is attached hereto.
 - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A **FIRST** preliminary amendment.
14. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☒ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items or information: International Search Report
International Preliminary Examination Report
PCT Notification of the Recording of a Change

U.S. APPLICATION NO. (If known, see 37 CFR 1.53) <div style="font-size: 2em; font-weight: bold;">10/070582</div>		INTERNATIONAL APPLICATION NO. PCT/CH00/00483		ATTORNEY'S DOCKET NUMBER 16795-2	
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21. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO. \$1040.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$890.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$740.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$710.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00 ENTER APPROPRIATE BASIC FEE AMOUNT =				CALCULATIONS PTO USE ONLY	
				\$	890
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$	
Total claims	15 - 20 =	0	x \$18.00	\$	0
Independent claims	2 - 3 =	0	x \$84.00	\$	0
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				\$	280
TOTAL OF ABOVE CALCULATIONS =				\$	1,170
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				\$	
SUBTOTAL =				\$	1,170
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
TOTAL NATIONAL FEE =				\$	1,170
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +				\$	80
TOTAL FEES ENCLOSED =				\$	1,250
				Amount to be refunded:	\$
				charged:	\$

a. ☒ A check in the amount of \$ 1,250 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees.
 A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any
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d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card
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NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR
 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

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Inkjet printing device for inks containing a high loading of pigment and Inkjet printing process utilizing said device

This invention relates to an inkjet printing device for inks containing a high loading of pigment, comprising an inkjet printhead for continuous printing, an ink reservoir, and a feeding circuit for feeding said printhead with ink from the reservoir and returning gutter ink from the printhead to the reservoir. The invention also relates to an inkjet printing process for inks having a high content in high density pigment.

There is an increasing interest in the printing of pigmented inks. However it is well known that when inks contain high density pigments the high density make them difficult to incorporate into inkjet inks. The Brownian motion of the particles in dilute solution is not sufficient to overcome gravitational forces and the particles tend to settle out of the ink and agglomerate. The continuous inkjet printing industry has battled against this problem for over ten years. It is still widely believed within this industry that in order for a pigmented ink to be successfully applied using inkjet the dispersion must be stable. This requirement places very stringent demands on the ink chemistry, more particularly when inks containing a high loading of pigment or having formulations with room temperature viscosities in excess of 12 cPs or inks that contain security features such as fluorescent pigments have to be applied with continuous inkjet printing technology.

It is an object of the present invention to propose a solution to this problem.

Experiments made by the Applicant with this end in view, have shown that through the utilisation of the device according to

A dispersion which exhibits soft settling is one in which the pigment settles out of dispersion on standing, but is readily redispersed by the application of mild agitation or shaking. A hard settling dispersion is one that cannot be readily redispersed after standing for a period of time.

According to a preferred embodiment, at least five static mixers are incorporated at strategic points within the system and the printhead feeding circuit comprises a filter placed between two static mixers, upstream of the printhead, and filter heating means arranged in such a manner that the ink temperature in the filter is higher than elsewhere in the printhead supply line. Further, a recirculation loop comprises a recirculation pump located between two static mixers

According to a second aspect, the invention relates to a process for inkjet printing with inks formed of a dispersion of particles in a liquid.

An embodiment of the device as well as an example of the process will be described hereinafter with reference to the drawing.

FIG. 1 is a schematic view showing a printing device incorporating the features of the invention.

Referring to the drawing, reference 1 designates an ink reservoir. The shape of this reservoir should preferably be such that efficient stirring of the ink is facilitated. It should not contain any "dead" volume. A cylindrical shape with a rounded bottom edge has been shown to be satisfactory. Also a hemispherical shape of the reservoir would be satisfactory. One experimental implementation of this concept has utilised a 500ml circular jar with a screw-on lid as a reservoir.

Ink is picked up in the reservoir through a feed line 2 and passes through a first static mixer 3. A static mixer is a well known apparatus which consists of a series of left and right hand helical elements located within a straight tube part. Several companies manufacture mixers of this type. Those manufactured by TAH Industries Inc., of New Jersey USA as well as those manufactured by Statiflo International Ltd., of Cheshire UK have been found to be useful.

Ink pick up line 2 feeds a pump assembly 17 and an ink supply and management system 16.

References 4 to 8 designate an ink recirculation loop which constitutes an important part of the schema. Ink is taken out of the tank 1 through a second static mixer 4, is passed

Tank 1 is positioned on top of a magnetic stirrer 11 and contains a magnetic stirrer bead 18. Thus two independent agitation means are provided: the recirculation loop 4-8 and the additional stirrer 11 and 18. The latter could also be a rotating mechanic stirrer.

The ink management block 16 includes the pump assembly 17, here symbolised through a pair of separate suction and driving pumps. However this representation is provided as an example only. The ink management block further includes a number of connection and valve and control means which are not represented in detail and which ensure control of the pressure and the composition of the ink: ink supply, solvent supply, measurement of viscosity, flow rate control, etc., as well as feeding of wash liquid. This system may include ink make up reservoir, solvent reservoir, etc.

A further line feeds ink from the management block 16 to the printhead 15. It comprises fifth and sixth static mixers 13

and 14 respectively and a filter 12 provided between the static mixers 13 and 14. Filter 12 is provided with heating means. At the outlet of mixer 14 the ink enters printhead 15 which is a single nozzle heated printhead. The gutter of printhead 15 is returned to ink management block 16 through line 10 and from there to the ink reservoir 1 through static mixer 9.

The operating conditions of the device described will now be discussed.

As has been stated above, the object of the device is to permit a continuous inkjet printer to function with inks containing difficult to disperse pigments. Increasing the viscosity of an ink increases the dispersion stability by decreasing the ease with which the pigment can settle out. However the continuous inkjet printers presently known are designed to work with inks of viscosities between 2.5 and 10 cPs, preferably between 2.8 and 4 cPs. It has been shown, however, that with the device described herein, ink formulations with room temperature viscosities in excess of 12 cPs can be printed. This makes possible the use of inks with higher pigment loadings or increased polymer stabilisation.

The heated ink delivery system as described above is an important feature. Thus for instance tests have shown that despite setting the printhead temperature at 50 degrees C a temperature of approx. 35 degrees C was the maximum that could be obtained. When the temperature of the ink supply was raised to 45-50 degrees C e.g. through passage of the ink in the loop 4-8, the desired head temperature could be achieved. Therefore both the heated printhead and heated ink delivery system are necessary.

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Certain aqueous base inks give rise to condensation on the charge electrode when used with a printer as described herein, especially when operating with an elevated printhead temperature. The formation of this condensation, which eventually causes the printer to cease working, can be prevented by the application of a slight positive pressure of air to the charge electrode or, preferably, through the application of low level heat.

Two different mixing technologies comprising a) mixing of the bulk ink in the tank through magnetic or other rotating stirring means and b) constant recirculation in a loop with static mixers, have been found to be necessary and to allow soft settling dispersions to be applied. Soft settling dispersions can be made with difficult to disperse pigments or additional materials intended to add further functionality to the ink.

The use of the described device not only maintains a homogeneous dispersion when the printer is working, but also allows an efficient redispersion of pigment after the printer has been shut down for a period of time (e.g. overnight). When restarting the machine it is only necessary to start the mixing systems in sequence, and then run for a short period of time prior to commencing printing. This redispersion process is aided by utilising a reservoir shape that does not contain any "dead" volume, as described above.

The association, as near as possible from one another, of a heated filter with static mixers located immediately before and after the filter, and of a heated printhead is a key component of the invention.

A heated filtration regime achieves excellent flow characteristics. The purity of flow through a filter is

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improved and less pressure is required to achieve an acceptable flow rate. Using high pressure with high viscosity would be detrimental to the maintenance of the filter. In addition, by heating the ink the viscosity is reduced which improves the filtration properties of the ink.

Reducing the viscosity increases the rate of pigment settlement, which is undesirable. Therefore to heat the ink to a higher temperature in the region of the filter than elsewhere in the ink supply line improves the filtration properties whilst minimising the settling rate elsewhere in the printer.

Finally a static mixer to the inlet of the filter prevents blockage or loading caused by heterogeneous flow of ink. A static mixer on the exit of the filter ensures that the ink leaving the filter is homogeneous. This is especially important just prior to the nozzle as ink homogeneity is a key requirement for reliable drop formation and jetting.

Tests.

Tests made with a printing device as described have shown the following results:

1. Ink with a viscosity of 5.6 cPs was printed under ambient conditions. The ink recirculation system was unheated. The recorded temperature of both the printhead and the ink was 27 degrees C. The pump pressure and the modulation voltage were set at 2900 mbar and 400 V respectively. The print quality was good.
2. Ink with a viscosity of 12.5 cPs was then printed with the inkjet printer operating in the same conditions as above.

(Printhead and ink temperature at 27 degrees C). Printing was not possible.

3. The same ink as for test No. 2 was then printed with raising the ink temperature to 44 degrees C and running the printhead at 35 degrees C. The pump pressure and modulation voltage were set at 2815 mbar and 600 V respectively. A satisfactory print could be obtained. The charge electrode was maintained at a temperature of approximately 60 degrees C during this experiment by heating with a 10 W radiant heat source to prevent the formation of condensation as described above.

This ink was observed to settle out within 1 hour of standing when the magnetic stirrer and recirculation loop were turned off, the ink temperature being maintained at 25 degrees C

4. Ink with viscosity of approx. 13 cPs was placed in the ink reservoir and then mixed using the magnetic stirrer and the recirculation loop 4-8 as described. Samples of ink were removed from the reservoir at intervals and their viscosity measured:

Time (min)	0	30	60	90	120
Viscosity (cPs)	13.3	13.9	13.7	13.6	13.4

Thus a stable dispersion is maintained when both mixing techniques are used. The viscosity was measured at 30 rpm.

5. After mixing for a period of 2 hours, the recirculation loop and the magnetic stirrer were turned off and the ink left to stand with no agitation.

Within approximately 10 min of the cessation of stirring one could observe visually a significant outsettling.

Time after cessation of stirring	30 min	15 hours
Measured viscosity (cPs)	11.3	11.4

Thus when no additional agitation is used, the dispersion readily settles out.

Maintenance process.

In addition to the different operating steps described above, the following maintenance process can be employed to further improve the reliability of this system.

The system should have a separate flush system containing clean filtered wash fluid. This will be in addition to the replenishment fluid.

Upon shutdown, ink is drained from the head and pipes, and returned to the internal ink container. Flush solution is then pumped throughout the system to rigorously remove the ink. Throughout the sleep mode the printer is left sealed, containing clean filtered wash fluid.

During the start up sequence, the ink within the ink container will be vigorously stirred, the wash fluid is pumped from the system and ink is introduced with a pulsed pressure regime.

Maintenance during operation will involve periodic flushing of ink throughout the system to ensure no settlement occurs. This will be achieved by briefly pulsing the system with ink between print jobs.

Air management will be important, e.g. by operating under negative pressure or degassing.

Claims

1. Inkjet printing device for inks containing a high loading of pigment, comprising an inkjet printhead (15) for continuous printing, an ink reservoir (1), and a feeding circuit (2, 10) for feeding said printhead with ink from the reservoir and returning gutter ink from the printhead to the reservoir, characterized in that the device further comprises on the one hand a two stages mixing arrangement comprising a recirculation loop (5, 6, 7) with mixing means (4, 8), taking ink from the reservoir and returning it to the reservoir, and a stirring system (11, 18) for ink contained in the reservoir, and, additionally, a means of heating the ink and ensuring the temperature of the ink is maintained at a predetermined temperature, above the ambient level.

2. Device according to claim 1, characterized in that at least five static mixers (3, 4, 8, 13, 14) are incorporated at strategic points within the system.

3. Device according to claim 2, characterized in that the printhead feeding circuit comprises a filter (12) placed between two static mixers (13, 14), upstream of the printhead, and filter heating means arranged in such a manner that the ink temperature in the filter is higher than elsewhere in the printhead supply line.

4. Device according to claim 2, characterized in that the recirculation loop comprises a recirculation pump (7) located between two static mixers (4, 8).

5. Device according to claim 4, characterized in that the recirculation pump is a peristaltic pump.

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6. Device according to claim 4, characterized in that the recirculation pump is associated with inlet and outlet tube segments (6) sunk in a heated block for maintaining the said main ink temperature level of the device

7. Device according to claim 2, characterized in that the said stirring means for ink in the reservoir consist of a magnetic stirring arrangement or of a mechanical rotating stirrer.

8. Inkjet printing process for inks having a high content in high density pigment, characterized in that an ink which exhibits the phenomenon of "soft settling" is prepared, and this ink is used for filling the ink reservoir of a printing device according to any one of the claims 1 to 7.

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**(19) World Intellectual Property Organization
International Bureau**



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15 March 2001 (15.03.2001)

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(72) Inventors; and

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(75) **Inventors/Applicants (for US only): CROCKETT, Dennis** [GB/GB]; 72 Westminster Gardens, Eye, Peterborough, PE6 7SP (GB). **HUDD, Alan, L.** [GB/GB]; Bury Cottage, Nuthampstead, Hertfordshire SG8 8NG (GB). **EVANS, Christopher, M.** [GB/GB]; 14 Ash Green, Great Chesterford, Essex CB10 1QR (GB).

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(74) **Agents:** GANGUILLET, Cyril et al.; ABREMA Agence Brevets et Marques, Ganguillet & Humphrey, 16, avenue du Théâtre, P.O. Box 2065, CH-1002 Lausanne (CH).

(26) Publication Language: English

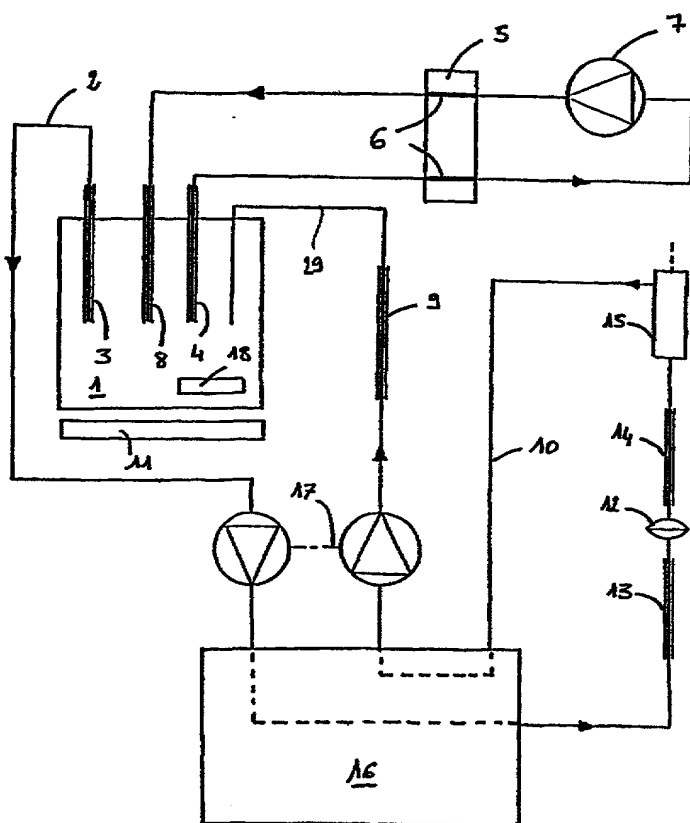
(30) Priority Data:
99810809.6 9 September 1999 (09.09.1999) EP

(71) Applicant (for all designated States except US): DE LA RUE GIORI S.A. [CH/CH]; Rue de la Paix 4, CH-1003 Lausanne (CH).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

[Continued on next page]

(54) Title: INKJET PRINTING DEVICE FOR INKS CONTAINING A HIGH LOADING OF PIGMENT AND INKJET PRINTING PROCESS UTILIZING SAID DEVICE



(57) Abstract: A continuous inkjet printer is described, which comprises a combination of dispersion agitation means, heated ink supply and print-head and tailored, heated, filtration regime. The use of this combination allows the printing of inks containing a non-magnetic pigment that exhibits "soft settling" upon standing.

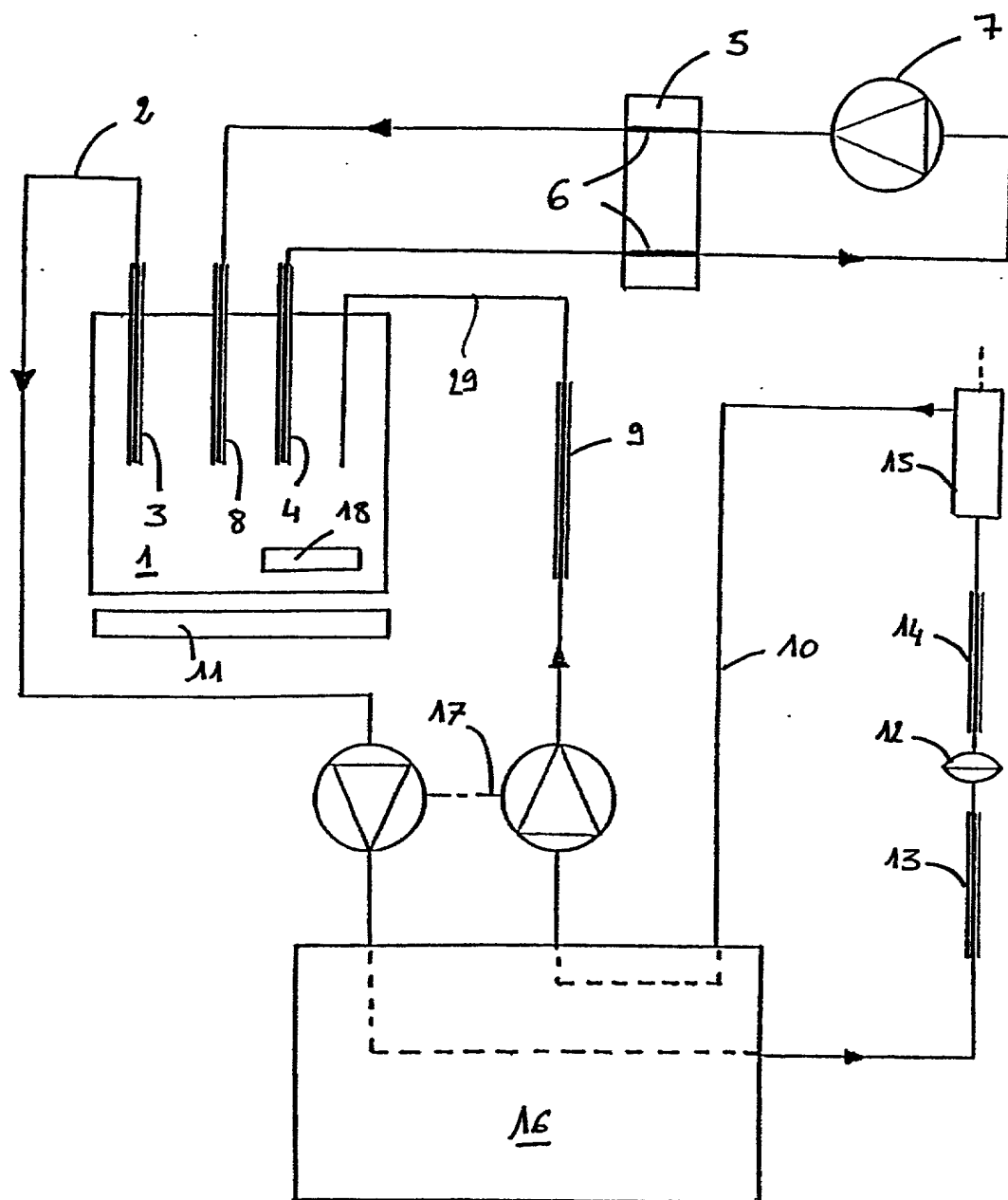


FIG.1

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)	Attorney Docket Number	16795-2
	First Named Inventor	Dennis Crockett
	COMPLETE IF KNOWN	
	Application Number	/
	Filing Date	
	Group Art Unit	
<input checked="" type="checkbox"/> Declaration Submitted with Initial Filing	OR	<input type="checkbox"/> Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)
Examiner Name		

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Inkjet printing device for inks containing a high loading of pigment and inkjet printing process utilizing said device

☐ the specification of which is attached hereto (Title of the Invention)

OR
☒ was filed on (MM/DD/YYYY) 09/08/2000 as United States Application Number or PCT International

Application Number ECT/CH 00/00483 and was amended on (MM/DD/YYYY) (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
99810809.6	EP	09/09/1999	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	
		<input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

(Page 1 of 2)

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DECLARATION — Utility or Design Patent Application

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

☐ Customer Number

OR

☒ Registered practitioner(s) name/registration number listed below

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Name	Registration Number	Name	Registration Number
Clifford W. Browning	32,201		

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

Direct all correspondence to: ☐ Customer Number or Bar Code Label ☒ Correspondence address below

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor:		<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle [if any])		Family Name or Surname			
Dennis		Crockett			
Inventor's Signature				Date	23/2/02
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Post Office Address	72 Westminster Gardens, Eye				
Post Office Address	Peterborough PE6 7SP				
City	Eye	State		ZIP	PE6 7SP
				Country	G.B.

☒ Additional inventors are being named on the 1 supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto

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PTO/SB/02A (3-97)
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DECLARATION

ADDITIONAL INVENTOR(S) Supplemental Sheet

Page 1 of 1

Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle (if any))				Family Name or Surname			
<u>Alan L.</u>				<u>Hudd</u>			
Inventor's Signature	<u>Alan L. Hudd</u>			Date	<u>21.02.02</u>		
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City	<u>Nuthampstead</u>	State		ZIP	<u>SG8 8NG</u>	Country	<u>G.B.</u>
Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle (if any))				Family Name or Surname			
<u>Christopher M.</u>				<u>Evans</u>			
Inventor's Signature	<u>[Signature]</u>			Date	<u>16/2/02</u>		
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Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
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Inventor's Signature				Date			
Residence: City		State		Country		Citizenship	
Post Office Address							
Post Office Address							
City		State		ZIP		Country	

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DECLARATION

REGISTERED PRACTITIONER INFORMATION (Supplemental Sheet)

Name	Registration Number	Name	Registration Number
Harold R. Woodard	16,214		
C. David Emhardt	18,483		
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John V. Moriarty	26,207		
John C. McNett	25,533		
Thomas Q. Henry	28,309		
James M. Durlacher	28,840		
Charles R. Reeves	28,750		
Vincent O. Wagner	29,596		
Steve Zlatos	30,123		
Spiro Bereveskos	30,821		
William F. Bahret	31,087		
Clifford W. Browning	32,201		
R. Randall Frisk	32,221		
Daniel J. Lueders	32,581		
Kenneth A. Gandy	33,386		
Timothy N. Thomas	35,714		
Kerry P. Sisselman	37,237		
Kurt N. Jones	37,996		
John H. Allie	39,088		
Holiday W. Banta	40,311		
Troy J. Cole	35,102		
L. Scott Paynter	39,797		
J. Andrew Lowes	40,706		
Charles J. Meyer	41,996		
Darrin Wesley Harris	40,636		
Matthew R. Schantz	40,800		
Gregory B. Coy	40,967		
Lisa A. Hiday	40,036		
John V. Daniluck	40,581		
Christopher A. Brown	41,642		
Jason J. Schwartz	43,910		
Arthur J. Usher IV	41,359		
Douglas A. Collier	43,556		
Scott J. Stevens	29,446		
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